United States Department of Agriculture **Forest Service** **Intermountain Region**

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Subject: FHP Report BFO-PR-05-01

To: Forest Supervisors, Boise and Sawtooth NFs

Enclosed is Forest Health Protection project report, BFO-PR-05-01. This report evaluates lodgepole pine stands affected by the mountain pine beetle (MPB) outbreak in the Sawtooth Valley of the Sawtooth National Recreational Area and susceptible stands in Bear Valley of the Boise National Forest. One objective of the report is to document the level of MPB-caused mortality of lodgepole pine in the Sawtooth Valley over the course of the current outbreak. An additional objective is to report on the establishment of MPB monitoring plots, located in susceptible lodgepole pine stands in Bear Valley.

If you have any questions, please contact Carl Jorgensen at 208-373-4225 or Dayle Bennett at 208-373-4227 in the Forest Health Protection Boise Field Office.

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Enclosure

cc: Carl L Jorgensen, Dayle D Bennett, Joy C Roberts, Barry F Stern, Dave Bassler, Brian Ferguson, Karl Fuelling, Sara E Baldwin, Joe Harper, Stephanie L Gripne, Barbara Bentz, Jesse Logan

Monitoring Mountain Pine Beetle-Caused Mortality of Lodgepole Pine in the Sawtooth and Bear Valleys of South Central Idaho, 2004

Report: BFO-PR-05-01

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INTRODUCTION

Mountain pine beetle (MPB), *Dendroctonus ponderosae* Hopkins, is a native insect that plays a major ecological role in mature and overmature pine forests of western United States and Canada. Having killed millions of pine trees in the past, MPB has a rich history in the Intermountain West. MPB outbreaks can cause dramatic tree mortality over extensive areas in only a few years often killing the largest host trees (>8 inch diameter) in high density stands (>100 sq. ft./acre basal area). These MPB outbreaks reduce average stand density, diameter and age of live trees. They also influence such things as canopy closure, stand structure, species composition, forage production, wildlife habitat, fuel loading, water yields, and aesthetics. Downfall and woody debris following outbreaks can also hamper access and use of land by livestock, big game and humans (McGregor and Cole 1985).

Mountain pine beetle populations have been building to epidemic levels in the Stanley Basin of the Sawtooth National Recreation Area (SNRA) since 1996 (Thier 1997). In 1998, the SNRA staff began spraying individual lodgepole pines in campgrounds with insecticides to protect them from attack by MPB. Other MPB management methods, such as verbenone and silvicultural treatments, have also been used on the SNRA to protect trees in some areas. Management strategies will not stop an outbreak once it has begun, but may reduce MPB impacts in localized areas. Typically, large MPB outbreaks only collapse due to one of two factors: a lack of susceptible host trees; or an extreme cold snap (<0 ˚F) in early fall or late spring and winter temperatures below –34 ˚F (Amman et al. 1989).

One objective of this report is to document the level of MPB-caused mortality of lodgepole pine in the Sawtooth Valley of the SNRA over the course of the current outbreak. An additional objective is to report on the establishment of MPB monitoring plots, located in susceptible lodgepole pine stands in Bear Valley on the Boise National Forest, west of the current outbreak. Whitebark pine tree mortality from MPB has also been dramatic on the SNRA, but these stands were not surveyed due to time constraints and difficulty in accessing these stands.

METHODS

During September 26-30, 2004, twelve transects consisting of ten plots each were established and sampled for MPB activity. Nine were located in Sawtooth Valley (SNRA) and three were located in Bear Valley on the Boise National Forest (Figure 1). Plots within transects were spaced 5 chains apart and trees within each plot were identified using a variable radius 10-factor prism. Surveyed trees were measured by 1-inch diameter at breast height (d.b.h.) size classes using a Biltmore stick. Each tree was identified by species and ranked into one of the following categories: green, unattacked; pitchout; current strip attack; current successful attack; successfully attacked in 2003, successfully attacked in 2002; successfully attacked prior to 2002.

Because the forest is always changing, the "snap shot" of average basal area and average d.b.h. was estimated for June of each year before the MPB attack period. Assumptions were made for "back dating" for the 2003, 2002, and 2001 stand conditions, as well as "projecting" the 2005 stand conditions. The first assumption is that the trees remained static from 2001 to 2005, so all the trees measured on the plot in the fall of 2004 remained the same 1-inch d.b.h. size class from 2001 to 2005. The second assumption is that living trees in the fall of 2004 would still be alive in 2005. Means and percentages were calculated using Microsoft Excel and JMP statistical software.

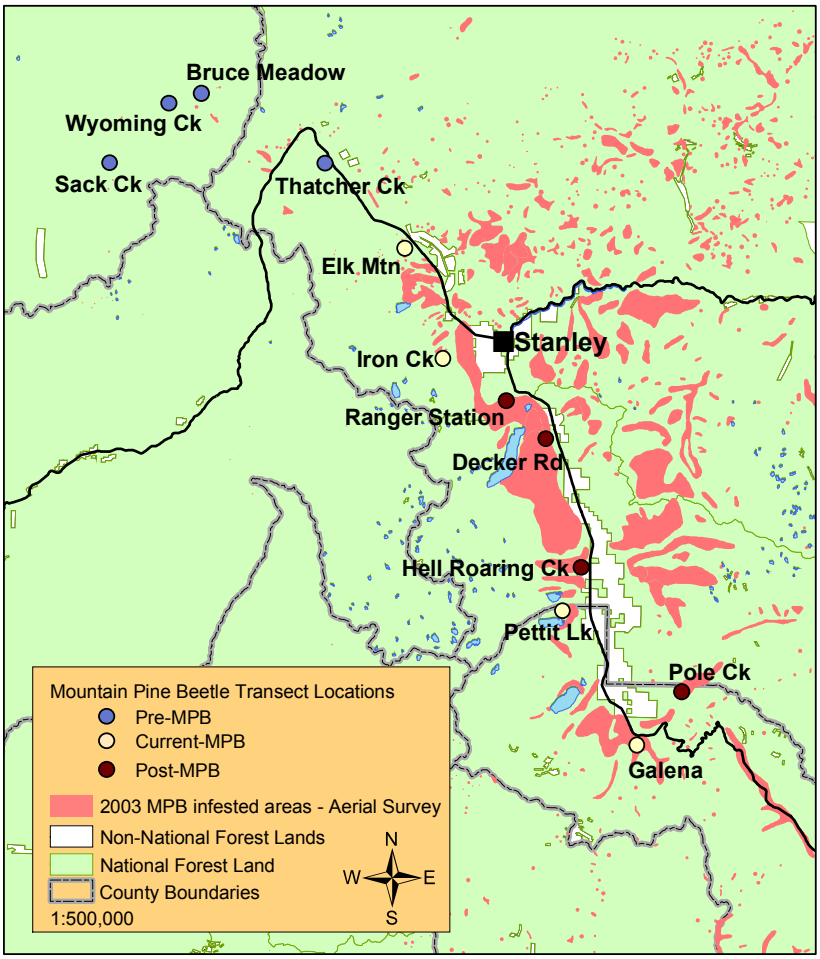

Figure 1. Location and name of transects for 2004 mountain pine beetle survey in lodgepole pine.

RESULTS AND DISCUSSION

Previous aerial surveys, the basal area graph (Figure 2), and visual observations of the transects were used to classify MPB population levels for each of the transects into the following categories:

- **Post-MPB** - Transect had substantial MPB activity 2 or more years ago.
- **Current-MPB** - Transect had substantial MPB activity in 2004.
- **Pre-MPB -**Transect had little or no MPB activity prior to sampling.

Post-MPB Transects -- Due to MPB caused mortality, the live basal area of trees on the post-MPB transects was dramatically reduced from 80-150 square feet per acre to between 50-75 square feet per acre (Figure 2).

The average d.b.h. of live lodgepole pine trees was also reduced in these transects. It was reduce by approximately 2 inches on the Ranger Station and Pole Creek transects (Figure 3).

Mortality rates were much higher for the larger trees than the smaller trees. Ninety-six percent of the lodgepole pine in 13-inch d.b.h. size class was killed by MPB in these transects (Figure 4).

Overstory lodgepole pine, for the purpose of this report, was defined as lodgepole pine trees that had a d.b.h. greater than or equal to 7 inches. Overstory lodgepole pine survival on the post-MPB transects varied between 31 and 47 percent (Figure 5).

Understory lodgepole pine, for the purpose of this report, was defined as lodgepole pine that had a d.b.h. less than 7 inches. Understory lodgepole pine survival on the post-MPB transects varied between 65 and 97 percent (Figure 6).

Current -MPB Transects -- MPB populations are still building on these transects. Current year's attacks were prevalent, and some reduction in live basal area and average d.b.h. of live trees has occurred (Figures 2 and 3). Many live, susceptible lodgepole pines remain and we expect continued mortality and resultant changes in stand structure will be similar to that found on our post-MPB transects. We plan to continue annually monitoring these transects for the duration of this outbreak.

Pre-MPB Transects -- Little, if any, mortality associated with MPB has occurred on these transects. However, many of the lodgepole pine stands within Bear Valley are highly susceptible to MPB attack and scattered MPB-caused mortality is evident throughout the area. We plan to continue annually monitoring these transects for the duration of the pending outbreak.

CONCLUSION

The current MPB outbreak on the SNRA has resulted in lodgepole pine survival and mortality rates similar to other MPB outbreaks in the Intermountain West. Survival rates of lodgepole pine trees greater than 4 inches d.b.h. on the Teton National Forest, Grand Teton National Park, and Targhee National Forest following a MPB outbreak resulted in rates of 62-90 percent (Amman and Baker 1972). Although many of the dominant lodgepole pine trees have been killed in the Sawtooth Valley, a large proportion of the understory lodgepole pines have survived (Figure 6). Similar mortality and survival rates can be expected in Bear Valley and in other susceptible lodgepole pine stands on the Sawtooth, Boise, and Salmon-Challis National Forests as the current outbreak progresses.

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Amman, G.D., M.D. McGregor, R.E. Dolph, Jr. 1989. Mountain pine beetle. USDA Forest Service Leaflet 2. USDA Forest Service, Washington, DC. 11 p.

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Thier, R.W. Memo To Forest Supervisor, Sawtooth NF, dated November 5, 1997. File Code 3420 Titled, "Mountain Pine Beetle, Riverside and Salmon River Campgrounds, SNRA."

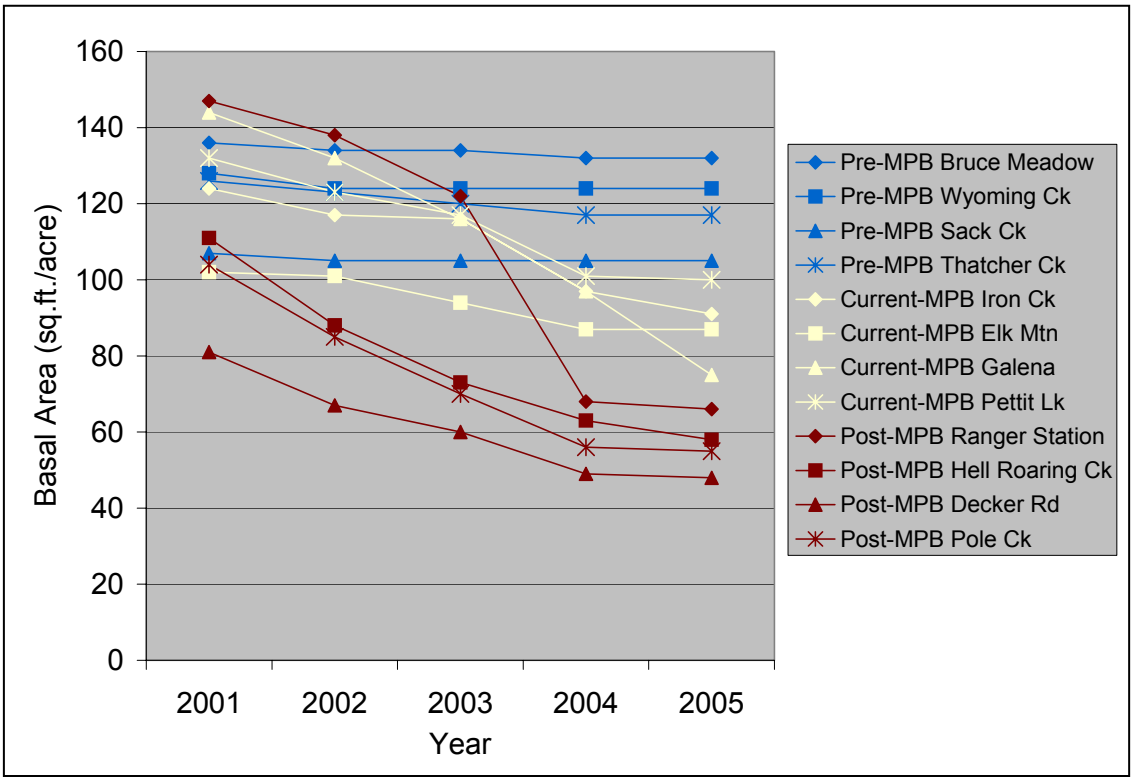

Figure 2. Average Basal Area (sq. ft/acre) from 2001 to 2005 at each of the transect locations grouped by pre-mountain pine beetle (MPB), current-MPB, and post-MPB population categories.

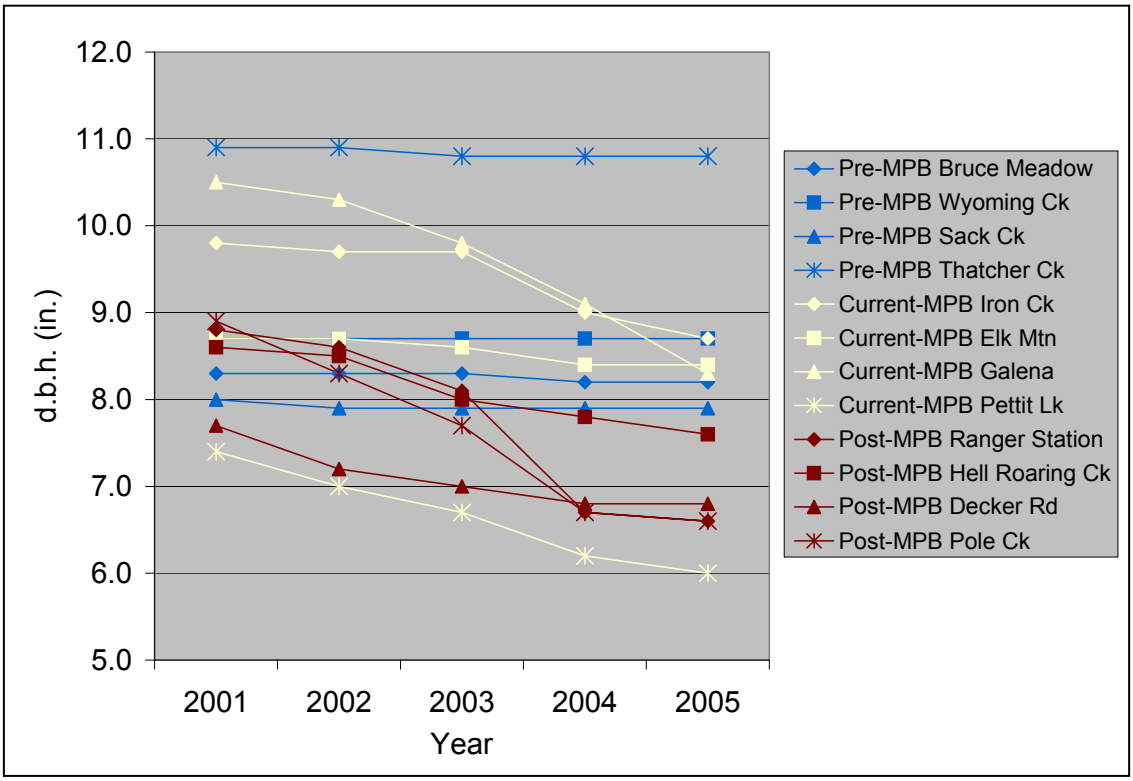

Figure 3. Average diameter at breast height (d.b.h.) from 2001 to 2005 at each of the transect locations grouped by pre-mountain pine beetle (MPB), current-MPB, and post-MPB population categories.

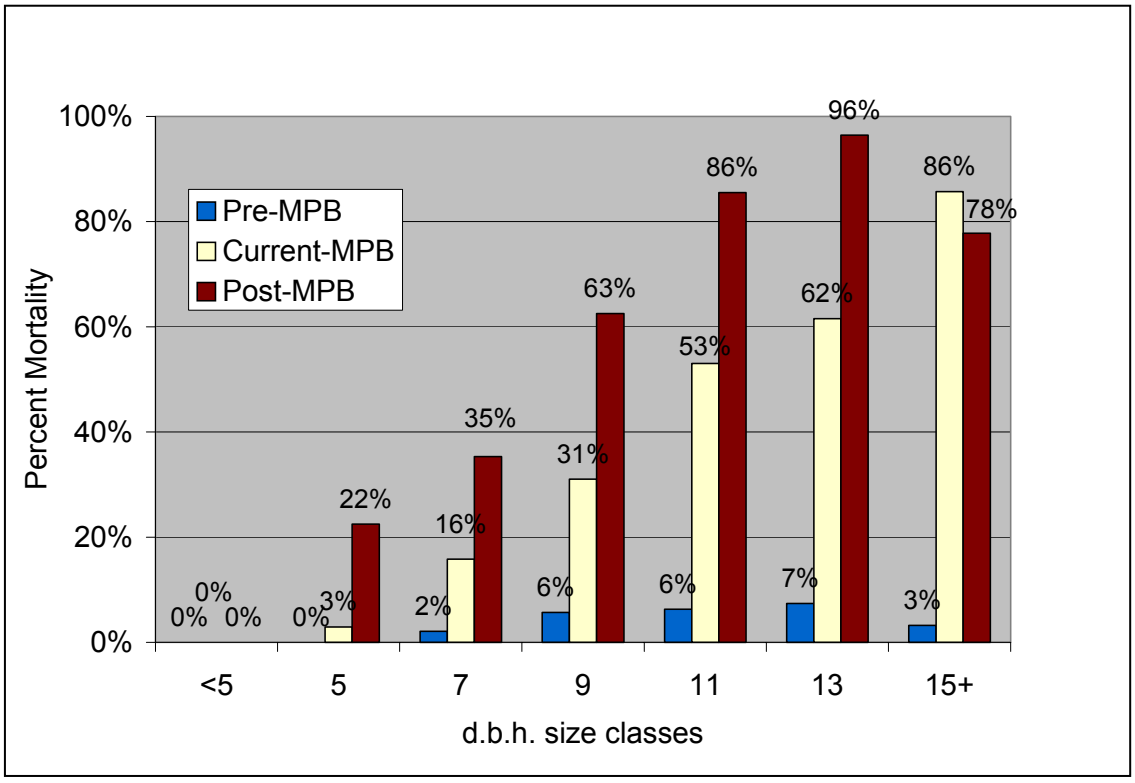

Figure 4. Percent of lodgepole pine mortality by mountain pine beetle (MPB) between 2001 and 2005 by 2-inch diameter at breast height size (d.b.h.) classes for the transects at pre-MPB, current-MPB, and post-MPB population categories.

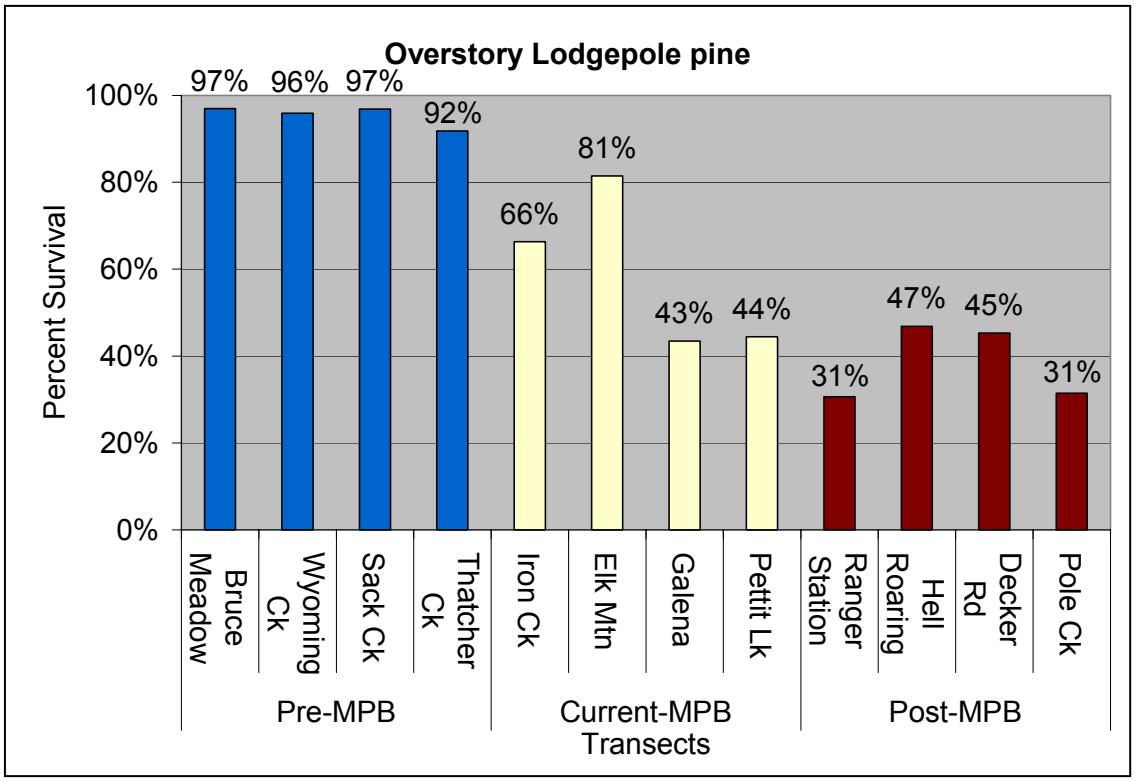

Figure 5. Percent survival of overstory lodgepole pine (greater than 7-inch d.b.h.) between 2001 and 2005 (projected) at each of the transect locations grouped by pre-mountain pine beetle (MPB), current-MPB, and post-MPB population categories.

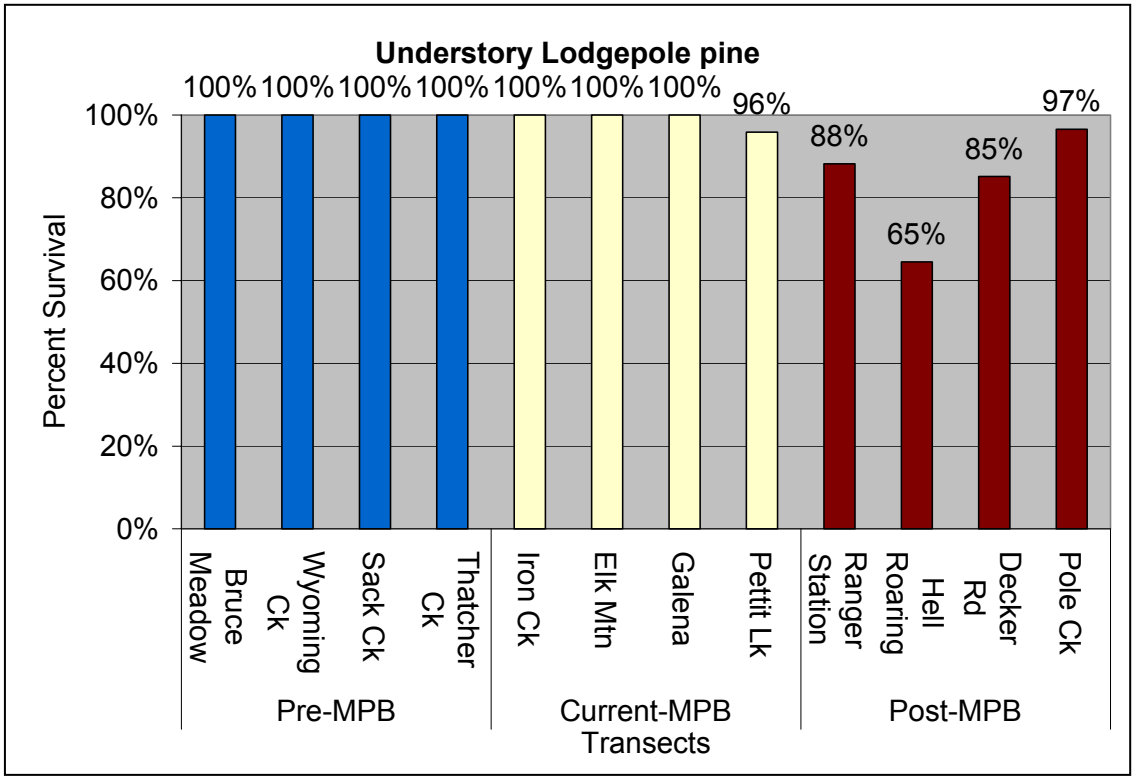

Figure 6. Percent survival of understory lodgepole pine (less than 7-inch d.b.h.) from 2001 to 2005 at each of the transect locations grouped by pre-mountain pine beetle (MPB), current-MPB, and post-MPB population categories.

Appendix 1. Number of live and dead lodgepole pine associated to mountain pine beetle by 2-inch diameter at breast height size classes per transect.

		<5		5		7		9		11		13		≥15	
	Transect	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live
Pre-MPB	Bruce Meadow	0	17	0	18	0	33	3	36	0	19	0	4	0	4
	Wyoming Creek	0	9	0	21	0	28	1	32	3	24	0	7	0	3
	Sack Creek	0	16	0	27	0	18	0	16	2	19	0	6	0	3
	Thatcher Creek	0	3	0	9	2	14	3	32	1	27	2	8	1	20
	TOTALS	0	45	0	75	2	93	7	116	6	89	2	25	1	30
Current-MPB	Iron Creek	0	9	0	14	3	12	8	25	6	21	7	6	9	1
	Elk Mtn	0	7	0	14	1	25	8	23	4	10	2	7	0	1
	Galena	0	4	0	14	1	20	15	25	22	4	13	2	18	2
	Pettit Lake	0	22	2	24	8	12	5	7	12	4	2	0	3	1
	TOTALS	0	42	2	66	13	69	36	80	44	39	24	15	30	5
Post-MPB	Ranger Station	0	12	4	18	14	20	18	11	30	3	11	0	4	0
	Hell Roaring Ck	0	4	11	16	9	20	12	10	12	5	4	0	5	2
	Decker Road	0	5	4	18	11	14	9	8	5	1	4	0	0	1
	Pole Creek	0	11	1	17	2	12	21	7	12	1	8	1	5	1
	TOTALS	0	32	20	69	36	66	60	36	59	10	27	1	14	4

Appendix 2. Number of lodgepole pine by mountain pine beetle attack category per transect.

	Transect	Unattacked	2004 Strip Attack	2004 Pitchout	2004 Attack	2003 Attack	2002 Attack	Prior to 2002 Attack
Pre-MPB	Bruce Meadow	130	0	0	0	2	0	2
	Wyoming Creek	123	0	1	0	0	0	4
	Sack Creek	106	0	0	0	0	0	2
	Thatcher Creek	117	0	0	0	3	3	3
Current-MPB	Iron Creek	80	5	3	6	19	1	7
	Elk Mtn	86	1	0	0	7	7	1
	Galena	64	6	0	22	19	16	12
	Pettit Lake	67	0	3	1	16	6	9
Post-MPB	Ranger Station	59	1	3	2	54	16	9
	Hell Roaring Ck	52	1	4	5	10	15	23
	Decker Road	45	0	2	1	11	7	14
	Pole Creek	45	4	1	1	14	15	19